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Keywords
banks, depository institutions, micro finance institutions, mortgages, Portfolio Choice, investment decisions

Disciplines
Economics | Finance | Finance and Financial Management

Do Consumers Choose the Right Credit Contracts?*

by

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Abstract

We analyze an experiment conducted by a large U.S. bank that offered consumers a choice between two credit card contracts, one with an annual fee but a lower interest rate and one with no annual fee but a higher interest rate. We find that on average consumers chose the credit contract that minimizes their costs. A substantial fraction of consumers (about 40%) still chose the suboptimal contract. Nonetheless, the probability of choosing the suboptimal contract declines with the dollar magnitude of the potential error, and consumers with larger errors are more likely to subsequently switch to the optimal contract.

JEL Classification: G11, G21, E21, E51

Keywords: consumption, borrowing, debt; balance sheets, consumer credit, credit cards, banking.

The literature has debated the quality of consumers' decision-making across different types of decisions.[5] This paper studies a central economic decision, the decision on different credit contracts. Compared to the asset side, the liabilities side of the consumers' balance sheet has not been analyzed very much, partly due to a lack of data (e.g., Odean 1998; Heaton and Lucas 2000). We analyze a unique market experiment conducted by a large U.S. bank. In 1996 all credit card holders at the bank were charged annual fees. However, in late 1996 in response to industry trends, the bank started offering new credit card customers a choice between two prespecified credit card contracts: one with an annual fee but a lower interest rate (APR), and one with no annual fee but a higher interest rate. To minimize their total interest costs net of the fee, the consumers that expect to borrow a sufficiently large amount should choose the contract with the annual fee, and vice versa. We use an administrative data set that records the contract choice and the subsequent monthly borrowing behavior of over a hundred thousand credit card holders at the bank from 1997 to 1999. This data set allows us to determine which account holders chose the suboptimal contract and if so how costly their mistake becomes. Further, the account holders have the option to later switch contracts. Therefore, we can also study whether they learned from and corrected their mistakes.

Credit cards play an important role in consumer finances, so they are a good test case for analyzing the quality of consumers' financial decision-making. In the mid-to-late 1990s (the start of our sample period), about 20 percent of the aggregate personal consumption was purchased with credit cards (Chimerine 1997). Moreover, for most households, credit cards, in particular bankcards (i.e., Visa, Mastercard, Discover, and Optima cards), represented the leading source of

[5] A number of recent studies have documented consumer financial decision-making. For example, Agarwal et al. (2009, 2013), Agarwal and Mazumdar (2013), Agarwal, Skiba and Tobacman (2009), Bertrand and Morse (2011), Campbell et al. (2011), Choi, Madrian, and Laibson (2012), and Stango and Zinman (2009), among others. In addition, DellaVigna and Malmendier (2006) find that consumers systematically choose suboptimal membership

unsecured credit. About two-thirds of the households at the time had at least one bankcard, and of these households at least 56 percent were borrowing on their bankcards, that is paying interest not just transacting (Survey of Consumer Finances (SCF), 1995).[6] Conditional on borrowing, the typical bankcard balance was about $2,000, with the account holder having roughly another $5,000 worth of balances on other cards. These are large magnitudes relative to typical household balance sheets. They are also large in the aggregate: total credit card balances amounted to about $700B in 2012 (Federal Reserve Board 2012).

The stakes involved in making such decisions on consumer credit are therefore potentially quite large. Also, whether to borrow or not on a credit card is a decision that most households effectively make on a monthly basis. Hence our results could be interpreted as a minimal test of the quality of consumers' financial decision-making.

After potentially rationalizing some salient aspects of the consumers' credit card usage, Gross and Souleles (2002a) highlight two more puzzling aspects. First, why does such a large percentage of consumers hold substantial credit card debt? Conventional buffer-stock models that are calibrated by estimating income processes have difficulty rationalizing so much borrowing at high interest rates (Angeletos et al. 2001; Laibson, Repetto, and Tobacman 2002). Second, why do many credit card borrowers simultaneously hold low-yielding assets, both illiquid and even liquid? For example, Gross and Souleles find that about one-third of the credit card borrowers have substantial assets in checking and savings that are beyond levels reasonably needed for cash transactions, which is apparently in violation of no-arbitrage conditions.

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plans at health clubs, but Miravete (2003) finds consumers' choices of telephone billing plans to be closer to optimal.

[6] As noted by Gross and Souleles (2002a), this figure probably understates the fraction of households borrowing on their bankcards, because SCF households appear to underreport their bankcard debt. See also Yoo (1998).

Some of the most common potential explanations for these puzzles are based on problems of commitment and self-control. For example, Laibson, Repetto, and Tobacman (2002) show that the consumers with hyperbolic discount functions, which generate time-inconsistency and commitment problems, are more likely than the consumers with standard exponential discount functions to borrow at credit card interest rates, and to simultaneously hold illiquid assets.[7] An innovative paper by Ausubel (1991) considers a related hypothesis as a potential explanation (among others) for the "stickiness" of credit card interest rates: consumers might repeatedly underestimate the probability that they will borrow (e.g., perhaps because they are unable to commit not to borrow), and so might be relatively insensitive to borrowing rates. Ausubel (1999) examines promotional "teaser" interest rates and concludes that consumers are overly sensitive to such rates, possibly because they underestimate the probability that they will later borrow at higher, post-teaser rates.[8,9]

The experiment that we study is ideally suited for analyzing such issues because consumers' choices between the two credit contracts at issue should critically depend on their expectations regarding their future borrowing. If consumers systematically underestimate their probability of borrowing, then we should find that many fail to pay the annual fee even though

[7] In analyzing the second, portfolio puzzle, it is useful to distinguish between liquid and illiquid assets. In the absence of additional frictions like transaction costs or mental accounts, hyperbolic consumers (e.g., Laibson, Repetto, and Tobacman 2002) would not violate no-arbitrage conditions, and so would not simultaneously hold credit card debt and liquid assets. However, other models with related self-control problems can potentially generate such outcomes. For instance, under "planner-doer" models (Thaler and Shefrin 1988), some people might undertake costly actions to constrain their "impulse" spending or spending by their spouses. By not fully paying off their credit card balances, such people can reduce their liquidity and thereby reduce the temptation of available credit (see Bertaut and Halliasos 2001). Gross and Souleles also consider additional explanations for the two puzzles. E.g., borrowers planning to file for bankruptcy have an incentive to hold some assets, up to the amounts protected by the bankruptcy exemption rules (see Lehnert and Maki 2002).

[8] Gross and Souleles (2002a) find significant elasticities of credit card spending and debt to changes in credit card APRs, even small, non-promotional changes. These results do not imply, however, that the card holders respond optimally to the APRs. Among other potential explanations for APR stickiness, Ausubel (1991), Calem and Mester (1995), and Calem, Gordy, and Mester (2005) point out that switching costs could also make consumers relatively less sensitive to the APR on a given credit card, *ceteris paribus*.

they later borrow substantial amounts. Conversely, it is also possible that some consumers overestimate their probability of borrowing, and needlessly pay the fee even though they do not borrow enough. With stochastic income and spending needs (e.g., medical emergencies, auto break-downs, etc.), some consumers of course find that they have chosen the suboptimal contract, even if their decision-making is perfectly rational (Souleles 2004). Hence, we investigate the role of shocks, and more importantly we focus on exploring the limits of the mistakes the consumers make. In particular we examine whether mistakes are less likely as the potential dollar loses increase in magnitude, and whether larger mistakes are more likely to be subsequently corrected.

We find that on average consumers chose the credit contract that minimizes their total interest costs net of the annual fee. A substantial fraction of consumers (about 40%) still chose the suboptimal contract, with a few non-fee-paying consumers incurring hundreds of dollars of readily avoidable interest charges. These suboptimal outcomes appear not to be entirely due to shocks. Nonetheless, the probability of choosing the suboptimal contract declines with the dollar magnitude of the potential error. Further, while relatively few consumers switch contracts, those who make larger errors in their initial contract choice are more likely to subsequently switch to the optimal contract. Thus most of the errors appear not to be very costly, with the noteworthy exception that a small minority of consumers who persist in holding substantially suboptimal contracts without switching.

The rest of the paper is organized as follows. In Section 1 we describe the data set. Section 2 comprises an analyzation of the consumers that do not switch contracts, which is the

[9] A few recent papers provide theoretical models of lending to consumers and entrepreneurs with various degrees of imperfect rationality or imperfect information. See Manove and Padilla (1999) and Bond, Musto, and Yilmaz (2005).

bulk of the sample, and Section 3 presents the robustness checks. In Section 4 we analyze the switchers, and Section 5 offers concluding remarks.

1. Data

We use a unique, proprietary panel data set from a large U.S. bank that issues credit cards nationally. The data set was created for other purposes internal to the bank. The data set includes a representative sample of about 200,000 credit card accounts opened as of December 1999. The sample does not include accounts that closed before that date, but it does include accounts that entered the portfolio between August 1997 (the start of the data set) and December 1999.

The bulk of the data consists of the main billing information listed on each account's monthly statement, such as the balance and the credit limit. Our debt variable comprises only interest bearing balances that rollover, not transaction balances that are paid off. Also available are the accounts' credit risk scores that are used by card issuers as summary statistics for the fundamental risk and profitability characteristics of each account.[10]

The data set contains three sub-portfolios based on the bank's general classification of the account holders' relationship with the bank. The first sub-portfolio comprises the account holders who have no prior banking relationship with the bank when they open their credit card accounts. The account holders in the other two sub-portfolios are existing customers of the bank. The second sub-portfolio comprises account holders with initial financial assets (combining CDs, IRAs, mutual funds, etc., as well as liquid assets) at the bank greater than $25,000, and liquid assets (combining checking, savings, MMMF, etc.) greater than $5,000. While we do not know

[10] The credit risk scores come from the credit bureaus, and so summarize the account-holders' credit activity across all of their credit cards and other debt. Our data set does not include any other credit bureau data, nor any demographic characteristics of the account-holders. Nonetheless, because the account-holders choose between the two offered contracts, we can analyze the optimality of their choices even without additional information regarding

which account holders with less assets at this bank have substantial assets elsewhere, the consumers with these levels of assets are relatively wealthy and liquid compared to the typical consumer in the United States. Henceforth we refer to the second portfolio as the wealthy accounts. All of the remaining account holders are put into the third sub-portfolio (relationship accounts).

The data set includes a variable that indicates which of the two credit card contracts the consumer chooses. The annual fees on the cards range from $10 to $23, and the increments in the annual APR in the absence of the fee range from 2.15% to 4.15%. The particular magnitudes of the fee and APR increment depend on the accounts. For example, the annual fee on the credit card only account holders is $23, and the annual APR increment without the fee is 4.15%. For the wealthy accounts, the fee and the annual APR increment are $10 and 2.15% respectively. However, within each sub-portfolio, every consumer received the choice of the same fixed annual fee and APR increment, so there was no pre-selection involved. After initially being required to choose one of the two contracts, the account holders subsequently had the option to switch to the other contract at any time. Only about 4% did so during our sample period.[11]

We exclude from the sample the accounts that are delinquent, bankrupt, or otherwise frozen; and the few accounts (about 300) that are offered a low teaser rate at any time within the sample period. The treatment of these accounts is determined by factors outside the contract choice at issue. We also drop employee and student accounts, because they too are treated differently. The resulting sample contains over 155,000 accounts.

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the rest of their credit cards. For an analysis of credit risk including credit bureau data, see Gross and Souleles (2002b) and Musto and Souleles (2005). Domowitz and Sartain (1999) also analyze consumer bankruptcy.

[11] Miravete (2003) and DellaVigna and Malmendier (2006) also find relatively few people switching in other contexts, telephone and health plans respectively.

While the data set is very rich, it does have some limitations. For example we did not get information about the consumers who received the offer but did not respond, nor the response rate to the offer. However, a comparison of the ex post credit scores, credit limits, and other credit card characteristics suggests that the consumers who respond are representative of credit card consumers in other studies (see Gross and Souleles 2002a; Agarwal et al. 2009). Also, the bank did not retain an exact copy of the offer flyer sent to consumers. But they provided the necessary details of the offer, and confirmed that the flyer simply and briefly described the offer along the lines described below, and that the wording on the flyer was the same for all of the offers.

Table 1 presents the key summary statistics across the sample accounts. Column (1) refers to all accounts, while columns (2) and (3) represent the accounts that pay and do not pay the annual fee. We refer to these accounts as "payers" and "non-payers" respectively. About 56% of the accounts are payers, and 44% are non-payers. Because about half of the account-holders chose each contract, their contract choice was quite possibly a deliberate decision (assuming they were not randomizing). In this first table the sample includes all accounts, including those that subsequently switch contracts, based on their initial contract choice. The results are very similar on dropping the relatively few switching accounts.

The payers receive an average interest rate break of about three percentage points (≈ 15.2% to 12.1%), but pay an annual fee averaging about $20. Also the payers and non-payers have similar credit scores and credit limits. Therefore, based on the information that issuers typically use to characterize accounts (both ex post and ex ante), these accounts appear to be relatively similar. However, the accounts that choose to pay the annual fee turn out to accumulate substantially more debt, more than twice as much. (For each account, we first

average the monthly debt over the entire sample period to reduce the influence of temporary debt due to special circumstances, for example, holiday shopping and long vacations abroad, and then averaged the results across the accounts.) Qualitatively, these results suggest the possibility that payers might have paid the annual fee in anticipation of reducing the interest costs on their relatively large future debt. Nonetheless it remains to be seen how many account holders actually choose the quantitatively optimal contract.

2. Results: Contract Choice

In this section we examine the account holders' contract choices and subsequent borrowing behavior to determine which account holders choose the suboptimal contract, and if so how costly is their mistake.

Table 2 reports the distribution of debt after the contract choice for the payers and non-payers. As in Table 1, column (1) shows that payers generally borrow more. In particular, conditional on paying the fee, over 31% of the payers carry debt of more than $1,200 per month on average over the entire sample period. In the second column, non-payers borrow less, with over 50% of them not borrowing at all over the entire sample period. However, about 23% of the payers do not borrow at all yet still pay the annual fee. It is possible that they overestimate the probability that they will borrow. Conversely, over 12% of the nonpayers borrow over $1,200 per month. Had they paid the fee, the resulting interest savings would have more than covered the fee. It is possible that they underestimate the probability that they will borrow.

However, the account holders that choose the incorrect contract might still make the optimal choice ex ante. Ex post, their borrowing needs might have happened to turn out differently than expected. For instance, some of the potential "underestimators" might not

initially have expected to borrow, with good reason, but might have subsequently been hit with adverse shocks, such as unexpected unemployment, that prompts them to borrow. Conversely, some of the potential "overestimators" might initially have expected to borrow, but might have subsequently benefited from positive shocks. With stochastic income and spending needs, we expect some of both of these contract errors.

While it is generally difficult to test ex post shock explanations (Souleles 2004), we can compare the results to those in column (2) for just the wealthy account holders. Only 22% of the wealthy account holders pay the annual fee, less than the 55% of the payers in the overall sample (bottom row). This is not surprising because wealthy account holders should have less need on average than others to borrow on their credit cards in the first place. However, conditional on not paying the fee, 10% of the wealthy non-payers nonetheless borrow over $1,200 per month. This result is broadly similar in magnitude to the fraction of the total sample of non-payers that borrows that much. Given the liquidity of these wealthy non-payers with high debt, it seems unlikely that unexpected bad shocks entirely explain why they borrow so much on their credit cards. Indeed, borrowing on credit cards while simultaneously holding substantial assets is the portfolio puzzle Gross and Souleles (2002a) highlight. Thus, shocks alone appear to be insufficient to rationalize the behavior of these consumers in the context of a conventional model. Conversely, conditional on paying the fee, a large fraction of the wealthy payers turn out not to borrow at all, about 40%.

Overall, comparing columns (1) and (2), the pattern of results is broadly similar across the wealthy versus all of the accounts. This is suggestive, albeit not conclusive, that shocks alone are not driving these results.

In Table 3, the top panel shows the percentages of account holders that choose the optimal and suboptimal contracts as in Miravete (2003). The first row computes the "net savings" from paying the fee, based on the potential gross interest savings from paying the net of the fee itself. This is the interest savings the non-payers would gain if they pay the fee, net of the fee, using their actual debt levels. If their net savings is positive, they should pay the fee. For the payers, it is the interest they are already saving, again net of the fee. If their net savings is positive, they have correctly paid the fee. So in either case, a positive number for net savings implies that the account holder should have paid the fee. These figures are calculated by averaging over the entire sample period, but are expressed in annual terms for comparison with the annual fee.

As reported in column (1), for non-payers the average net savings is slightly negative (-$1.90). That is, on average the non-payers are correct to not pay the fee. In fact, almost 80% of them choose the optimal contract, even ex post; only 21% choose the suboptimal contract. By contrast, for payers the average net savings is positive, over $22, and on average the payers are correct to pay the fee. However, the median net savings is negative, so that slightly more than half of the payers, about 55%, choose the incorrect contract. Overall, combining both payers and non-payers, the majority of account holders choose the optimal contract, although about 40%, still choose the suboptimal contract. Again these results are generally similar to the wealthy account holders in column (2).

For the account holders who choose the incorrect contract, how significant are their errors? More account holders err by incorrectly paying the annual fee than by incorrectly not paying the fee. Therefore, for account holders who incorrectly pay the fee, the cost of the error is

bounded by the fee itself, which is relatively small.[12] By contrast, for the account holders who do not pay the fee but should have, the losses can be much larger because they can potentially borrow thousands of dollars. The bottom panel of column (1) shows the distribution of the error costs. For 225 non-payers, the net error is over $200 of avoidable interest payments per year; for 30 non-payers, it is over $300 per year. Because these account holders have the option to switch contracts, their failure to do so is particularly noteworthy. Also, these figures reflect just one of the credit cards they hold. Because the average account holder has multiple cards, the errors could be even larger at the household level. Hence, for a small minority of account holders the costs of their incorrect contract choice appear to be significant.

On the other hand, as the net savings increase in magnitude (moving down the table), the fraction of accounts not paying declines, from 37% not paying at a net savings of $0–$25, to less than 7% not paying at a net savings above $300. In other words, as the stakes increase, consumers are increasingly likely to choose the optimal contract. Otherwise the total losses from the suboptimal contracts would be much larger.

For the wealthy account holders, the same qualitative patterns appear. A larger percentage of wealthy accounts with high net savings are non-payers, though an error of a given dollar amount might matter less to the wealthy.

[12] Further, bringing in risk-aversion, some account holders might pay the annual fee for insurance purposes. Considering that the annual fees are only $10–$23, which is an affordable option to borrow later at a lower rate, ex-ante account holders might be better off having paying even they do not use the insurance later. With even a small

3. Robustness Checks

Our baseline results in Table 3 suggest that on average consumers choose the contract that minimizes their net costs. In this section, we conduct several tests to verify the robustness of the preceding results.

First, there is a limitation associated with our data set. Our sample does not include accounts that closed before December 1999. Some account holders were forced to close their accounts due to default, bankruptcy, or fraud. We do not believe that these accounts could bias our results significantly as they represent a relatively small fraction of the credit card accounts. However, the account holders who deliberately close their accounts with the bank and switch to other banks is a concern. The account holders could switch for various reasons. One plausible explanation is that these account holders make mistakes and incur high costs relative to outside options. Under this circumstance, the omission of these accounts from our sample could cause the underestimation of the proportion of people making mistakes in the baseline results because they are more likely to choose incorrect contracts. On the other hand, certain account holders who are sophisticated in managing their credit card financing tend to proactively switch to other banks' cards as long as that can minimize their costs of borrowing. So, those account holders are less likely to make mistakes in choosing their contracts. As a result, it is not clear how closed accounts could plausibly bias the results.

To address this issue, we consider a sample of accounts created in 1999. Those accounts that opened close to December 1999 should include the account holders who would switch later. We divide the sample into two: one includes accounts that were opened in the first half of 1999 and another for those opened in the second half of the year. For the subsamples, we compute the

probability of a moderate liquidity shock, it can be optimal under a wide set of preference parameters to pay for cheap insurance of this type. As a result, a caveat to the interpretation of the above findings should be noted.

average net savings for both payers and non-payers and also calculate the fractions of account holders that choose the optimal and suboptimal contracts, as in Table 3. Columns (1) and (2) in Table 4 report the results. For accounts opened in the first half of 1999, the average net savings is $20.34 for payers and -$6.05 for non-payers. Of the payers and non-payers, 42% and 84% are in the optimal contract respectively. For the accounts opened in the second half of 1999, the average net savings is $12.35 for payers and -$7.39 for non-payers, while 37% of the payers and 85% of the non-payers correctly choose the right contract. The results from the two subsamples are similar to each other and to the results in Table 3.[13]

Second, Table 2 reports over 23% and 50% of payers and non-payers, respectively, carry zero debt over the entire sample period. It is understandable for non-payers but not for payers. The payers should not have paid the fee. More surprisingly, among the zero debt accounts, there are a number of them who never use their credit cards at all. We are concerned with the possibility that these account holders do not deliberately choose their contracts in the first place. To address the potential bias, we perform a robustness check by excluding accounts with no purchasing and borrowing activities over the sample period. The results are reported in column (3) of Table 4. After excluding 2,854 payers and 16,434 non-payers from the original sample, we still observe similar results as in Table 3. The average net savings is $24 for payers and $2.70 for non-payers. Of the payers and non-payers, 46% and 73% are in the optimal contract respectively.

Third, because an account holder could switch contracts potentially every month, but has to pay the annual fee only once a year, the results could be affected by volatile borrowing behavior. For example, consider a non-payer who has to borrow heavily for just one month but then pays off the debt the following month. The net savings based on the average borrowing

[13] Our main results are qualitatively similar by using accounts that were opened in 1998. These results are available upon request.

during the sample period would be positive and, if large enough, would imply that the account holder should have paid the fee. But if the borrowing is unexpected and transitory, the account holder might rationally have not paid the fee.

To address such issues, we consider the subsample of non-switchers who have at least 24 months of data. We split the sample at 12 months and compute the average net savings separately. The results from the two periods are reported in columns (4) and (5) respectively. They are similar to each other (and also with the results in Table 3). For payers the average net savings is $27.26 in months 1–12 and $28.28 in months 13–24. Of the payers 47% and 45% are in the optimal contract in months 1–12 and months 13–24 respectively. Of the non-payers 76% and 79% are correct to not have paid the fee in months 1–12 and months 13–24 respectively. The average net savings of the non-payers for the two periods are also similar (-$1.65 vs. -$0.85). Overall, the distributions of the net savings for payers and non-payers in the two periods are generally similar to the results in Table 3.

Next, we consider the case of calculating the net potential savings separately in each month t, NS(i,t), by using debt at month t annualized minus the fee. Then we compute how many of the total account-months (i,t) are in the correct contracts. We find that 42% of the account-months are in the suboptimal contract, just slightly above the 40% figure for the entire sample period in Table 3. The robustness of the results over different horizons for calculating the net savings reflect the fact that the account debt is quite persistent.[14]

[14] Account debt has an AR(1) coefficient above 0.9 (for both switchers and non-switchers). We also compute how many accounts are in the wrong contract at least once (i.e., what fraction of i's have the wrong net savings in at least one month t). We find that only 62% of the resulting accounts are in the wrong contract at least once; i.e., 38% are never in the wrong contract during the sample period. These results are available on request.

4. Results: Contract Switching

Only about 6% of the initial payers switch to not paying during the sample period, and less than 1% of the initial non-payers switch to paying. The fact that so few account holders switch contracts could partly reflect the transaction costs and inertia.[15] We focus on whether, conditional on switching, the right accounts switch.

Table 5 compares the switchers both before (top panel) and after (bottom panel) they switch. In column (3), (pay, not pay) refers to the accounts that start by paying the annual fee, but later switch to the contract without the fee. Conversely, in column (4), (not pay, pay) refers to those that switch from the contract without the fee to the contract with the fee. In columns (1) and (2), (pay, pay) and (not pay, not pay) refer to the accounts that do not change contracts.

In the top panel, the results for the accounts that do not switch are calculated as in Table 3. Their net savings are again first averaged over the entire sample period and expressed in annual terms. For accounts that switch, the potential net savings before the switch are averaged over all of the available months before the switch, and again annualized. In column (1) the accounts have positive net potential savings on average (though slightly more than half of the accounts choose the suboptimal contract). In column (3), although the accounts initially pay the fee, their net benefits from paying are negative on average (-$16), and over 90% of them are in the suboptimal contract at the time. That is, of the account holders initially choosing to pay the annual fee, those for whom the choice is incorrect and relatively costly are disproportionately likely to later switch to the other contract. Similarly, in column (2), compared to the accounts that remain non-paying (not pay, not pay) that have negative net savings, those that are initially

[15] O'Donoghue and Rabin (2001) show that naïve hyperbolic discounting can generate substantial procrastination even with small per period transaction costs to acting. In our sample period, no accounts switch more than once. We cannot however tell whether some of the accounts that do not switch within our sample period might have switched before we begin to observe them at the start of the sample period in August 1997, so these reported fractions

non-paying but later switched to paying, (not pay, pay) in column (4), have positive and relatively large net benefits from switching. Again, the accounts that switch tend to be the ones with the largest errors to correct.

Switching in response to past errors is appropriate only if past errors are predictive of potential future errors, although account debt is in fact persistent. The bottom panel in Table 5 directly examines the benefits of switching. It computes the net savings over all of the available months after the switch, and again annualized. In column (3), for those that stop paying, the net potential savings become even more negative. Over 96% of these switchers are in the optimal contract after their switch, whereas 93% of them are in the suboptimal contract beforehand. In column (4), for those that start off paying, the net potential savings become even more positive, almost $50 on average. Over 67% of them are in the optimal contract after their switch, whereas 61% of them are in the suboptimal contract beforehand. These results are consistent with the switches generally being forward-looking.

Table 6 estimates the multivariate logit models that analyze the switching. In column (1) the sample comprises all of the accounts that initially pay (i.e., both (pay, pay) and (pay, not pay)), with the dependent variable equal to one for those that subsequently switch to not paying ((pay, not pay)). Conversely, column (2) contains all of the accounts that initially do not pay, with the dependent variable equal to one for those that subsequently switch to paying. All of the independent variables are averaged over all months before a switch, and again annualized. The credit score and credit limit are used to control for account heterogeneity.

Column (1) models those who stop paying the annual fee. The coefficient on the net savings is significantly negative. Hence, as the net benefits of paying the fee increase, account

somewhat understate the total incidence of switching. As already noted, other studies also find relatively little switching in other settings.

holders are less likely to stop paying the fee and vice versa, which is consistent with Table 5. Further, "% Months Borrow" measures the percentage of months before the switch in which the account holder borrows. This variable has a significantly negative effect. Even controlling for the dollar magnitude of borrowing, the account holders who borrow a greater number of times are less likely to stop paying the fee, and vice versa. Conversely, column (2) models those who start paying the annual fee. Here the net savings has a significantly positive effect. The account holders with greater benefits from paying are indeed more likely to keep paying.[16] The number of months of borrowing has a significantly positive effect, so account holders who borrow a greater number of times are more likely to keep paying the fee. Thus, the probability of switching increases with both the size of the past error and with the number of times the account holder errs. These results are suggestive of learning.

5. Conclusion

We use a special data set of credit card accounts to study a unique experiment that offers consumers a choice between two different credit contracts: one with an annual fee but a lower interest rate and one with no annual fee but a higher interest rate. The optimal contract choice depends primarily on the consumers' expectations of their future borrowing and so represents an ideal test case for studying the quality of consumers' decision-making in an important market context: consumer credit.

[16] To interpret the estimated effect of net savings, in column (1) a $100 increase in net savings leads to a 3.7 percentage point (p.p.) decrease in the probability of stopping to pay the fee, evaluating at sample means. Relative to the sample average probability of stopping to pay of just under 6%, this corresponds to a 69% relative decline in the probability of switching in this direction, a substantial effect. In column (2), a $100 increase in net savings would lead to a 0.18 p.p. increase in the probability of starting to pay the fee. While this is a smaller effect, the sample average probability of starting to pay is only about 0.7%, so the implied effect corresponds to a 24% relative increase in the probability of switching, again a substantial effect.

We find that on average consumers chose the credit contract that minimizes their interest costs net of the annual fee. For consumers that do not pay the fee, on average the potential interest savings turn out to be smaller than the fee; for consumers that pay the fee, on average the interest savings turn out to be larger than the fee. However, a substantial fraction of consumers, about 40% overall, chose the suboptimal contract. While more consumers incorrectly pay the fee than incorrectly fail to pay the fee, the mistakes of the payers are bounded in magnitude by the fee itself, which is relatively small. By contrast a few non-payers incur hundreds of dollars of avoidable interest charges. These suboptimal outcomes seem unlikely to be entirely due to shocks to income and spending needs, because the pattern of mistakes is similar for wealthy consumers who should be less likely to need to borrow on their credit cards in response to shocks. Nonetheless, the probability of choosing the suboptimal contract declines with the dollar magnitude of the potential error. That is, as the stakes increase, consumers are increasingly likely to choose the cost-minimizing contract.

Furthermore, while relatively few consumers switch contracts, those who make larger errors in their initial contract choice are more likely to subsequently switch to the other contract. The probability of switching also increases with the number of times that consumers err in the past. Notably, most of the switchers are in the optimal contract after the switch, whereas most of them are in the suboptimal contract before the switch. These results are generally consistent with learning and the switches being forward-looking.

In sum, most consumers chose the optimal credit contract, and for those who chose the suboptimal contract, most of their errors appear not to be very costly. A noteworthy exception, however, is that a small minority of consumers persist in holding substantially suboptimal contracts without switching. Such results could potentially motivate policies that might "nudge"

consumers who are in incorrect contracts to consider switching contracts. The Credit Card Act of 2009 represents a significant step by Congress to protect consumers in the credit card market by establishing a number of disclosure requirements to enhance fair and transparent practices pertaining to open-ended consumer credit plans. For example, one of the provisions of the Card Act requires issuers to give consumers more time to make alternative credit arrangements before unilateral changes to the credit card contract become effective. It certainly helps consumers in making rational decisions in the credit card market. However, whether the statute succeeds in adequately protecting consumers in the credit card market is still a much debated issue. Anecdotal evidence suggests that credit card issuers have raised interest rates and fees, lowered credit limits, and have closed unprofitable accounts in advance of the legislation (Jambulapati and Stavins 2014).

We end with some additional caveats. First, the choice between the two contracts is especially simple. As already noted other aspects of consumers' credit card usage are more puzzling, and consumers might have more trouble making decisions in other contexts, especially less simple and less familiar decisions (e.g., Agarwal, Driscoll, and Laibson 2012). Second, even small deviations from optimal decision-making at the consumer level might still potentially have important aggregate implications (e.g., Gabaix and Laibson 2006; or analogously for firms, Akerlof and Yellen 1985). Third, even though we find that relatively few consumers make mistakes that are economically costly, a subsequent paper by Agarwal et al. (2009) shows that consumers make mistakes across many domains of financial decision-making, and such mistakes are likely to be correlated. Thus, together they can add up to be economically costly to consumers.

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Table 1
Summary statistics

	(1) All Accounts	(2) Accounts Paying Annual Fee ("payers")	(3) Accounts Not Paying Annual Fee ("non-payers")
Annual fee ($)			
mean	11.90	21.14	0.00
s.d.	10.94	4.16	0.00
Interest rate (%)			
mean	13.37	12.09	15.20
s.d.	1.71	0.55	0.86
Credit score			
mean	728	726	729
s.d.	94	96	90
Credit limit ($)			
mean	6,026	6,077	5,961
s.d.	2,957	2,658	3,301
Average Monthly Debt ($)			
mean	801	1,070	455
s.d.	1,442	1,626	1,068
Number of accounts	155,376 (100%)	87,460 (56.2%)	67,916 (43.8%)

This table shows summary statistics for our main variables. Means and standard deviations (s.d.) are computed across accounts after first averaging each variable for each account across the entire sample period ranging from august 1997 to December 1999. Fee-paying status is taken at of the beginning of the sample. For accounts subsequently switching contracts, only the period of the initial contract is included.

Table 2
Distribution of debt by credit contract

	(1) All Accounts		(2) Wealthy Accounts	
Average Monthly Debt	Paying Fee ("payers")	Not Paying Fee	Paying Fee ("payers")	Not Paying Fee
$0	23.4%	50.3%	39.9%	55.4%
$0-100	14.6%	15.2%	12.9%	17.4%
$101-500	16.6%	13.7%	13.8%	11.6%
$501-1200	14.3%	8.7%	10.0%	5.8%
>$1200	31.1%	12.2%	23.4%	9.9%
total	100.0%	100.0%	100.0%	100.0%
# accounts	82639	67411	6370	22477
% pay vs. not pay	55.1%	44.9%	22.1%	77.9%

This table shows the distribution of debt after the contract choice for the payers and non-payers. Debt is average monthly debt over all months in the sample. Wealthy accounts have at least $25,000 of financial assets, including $5,000 in liquid assets, at the same bank. This sample excludes accounts switching contracts.

Table 3
Net savings and contract choice

	(1) All Accounts		(2) Wealthy Accounts	
	Paying Fee ("payers")	Not Paying Fee	Paying Fee ("payers")	Not Paying Fee
Net savings from paying fee				
Mean ($)	22.91	-1.87	9.85	-1.31
% optimal contract	44.5%	79.0%	34.2%	83.8%
% suboptimal contract	55.5%	21.0%	65.8%	16.2%
% optimal/suboptimal overall	60.0% / 40.0%		72.9% / 27.1%	
Distribution of Net savings ($): # of accounts, % pay vs. not pay				
< $0	45901	53227	4190	18839
	46.3%	53.7%	18.2%	81.8%
$0-24	10856	6431	935	1871
	62.8%	37.2%	33.3%	66.7%
$25-49	7118	3074	472	705
	69.8%	30.2%	40.1%	59.9%
$50-99	9044	2972	510	721
	75.3%	24.7%	41.4%	58.6%
$100-199	7426	1482	246	313
	83.4%	16.6%	44.0%	56.0%
$200-299	1852	195	17	26
	90.5%	9.5%	39.5%	60.5%
>=$300	442	30	0	2
	93.6%	6.4%	0.0%	100.0%
# accounts	82639	67411	6370	22477
% pay vs. not pay	55.1%	44.9%	22.1%	77.9%

This table reports net savings and the distribution of net savings after the contract choice for the payers and non-payers. Net savings is the potential savings in interest costs on paying the annual fee (whether or not the account holder actually paid the fee), net of the fee itself, assuming the same debt levels. It is averaged over the entire sample period but is expressed in annual terms. The % suboptimal is the fraction of accounts that chose the suboptimal contract. For non-payers, it is the fraction whose gross savings exceeds the fee. For payers, it

is the fraction with gross savings less than the fee. This sample excludes accounts switching contracts.

Table 4
Results from robustness tests

	(1) Accounts Opened Between 1 -6/1999		(2) Accounts Opened Between 7--12/1999		(3) Active Accounts		(4) First 12 Months		(5) Second 12 Months	
	Paying Fee ("payers")	Not Paying Fee	Paying Fee ("payers")	Not Paying Fee	Paying Fee ("payers")	Not Paying Fee	Paying Fee ("payers")	Not Paying Fee	Paying Fee ("payers")	Not Paying Fee
Net savings from paying fee										
Mean ($)	20.34	-6.05	12.35	-7.39	24.00	2.70	27.26	-1.65	28.29	-0.85
% optimal contract	41.7%	84.0%	32.8%	86.8%	45.6%	73.0%	47.0%	75.9%	44.8%	78.7%
% suboptimal contract	58.3%	16.0%	67.2%	13.2%	54.4%	27.0%	53.0%	24.1%	55.2%	21.3%
% optimal/suboptimal overall	65.1%/34.9%		61.8%/38.2%		56.3%/43.7%		58.2%/41.8%		57.9%/42.1%	
# accounts	7601	9421	7860	9161	79785	50977	48750	30823	48750	30823
% pay vs. not pay	44.7%	55.3%	46.2%	53.8%	61.0%	39.0%	61.3%	38.7%	61.3%	38.7%

This table shows the percentages of account holders that choose the optimal and suboptimal contracts. The first row computes the net savings from paying the fee, based on the potential gross interest savings from paying the net of the fee itself. This is the interest savings the non-payers would gain if they pay the fee, net of the fee, using their actual debt levels. The % suboptimal is the fraction of accounts that chose the suboptimal contract. For non-payers, it is the fraction whose gross savings exceeds the fee. For payers, it is the fraction with gross savings less than the fee.

Table 5
Net savings and switching contracts

(first contract, second contract)	(1) (pay, pay)	(2) (not pay, not pay)	(3) (pay, not pay)	(4) (not pay, pay)
Before switch: Net savings				
mean ($)	22.9	-1.9	-15.9	36.5
% initial contracts optimal	44.5%	79.0%	7.07%	39.41%
% suboptimal	55.5%	21.0%	92.9%	60.6%
After switch: Net savings				
mean ($)			-17.9	47.5
% optimal after switching			96.2%	67.1%
% suboptimal			3.8%	32.9%
# obs	82,639	67,411	4,821	505

This table reports the switchers' net savings both before (top panel) and after (bottom panel) they switch. The (pay, pay) and (not pay, not pay) include the accounts that do not change contracts during the sample period. The (pay, not pay) includes accounts that switched from paying to not paying, and (not pay, pay) contracts switched from not paying to paying. For accounts that do not switch, the net savings (see Table 3) is averaged over the entire sample period but is expressed in annual terms. For accounts that switch, the net savings before the switch are averaged over all available months before the switch, and annualized again. And the net savings after the switch are averaged over all available months after the switch and annualized again.

Table 6
Learning and switching contracts

Dependent Variable	(1) Stop Paying the Fee: (pay, not pay) vs. (pay, pay)			(2) Start Paying the Fee: (not pay, pay) vs. (not pay, not pay)		
	coef.	s.e.	p-value	coef.	s.e.	p-value
Net Savings	-0.015	0.002	<.0001	0.004	0.001	<.0001
% Months Borrow	-2.126	0.103	<.0001	2.007	0.150	<.0001
Credit Limit/1000	0.034	0.006	<.0001	0.068	0.013	<.0001
Credit Score/1000	0.378	0.135	0.005	-2.335	0.233	<.0001
Constant	-2.706	0.115	<.0001	-4.592	0.208	<.0001
# obs		87,460			67,916	
Pseudo R2		0.128			0.094	
Log likelihood		-16269.3			-2699.8	

This table estimates the cross-sectional logit models of accounts that switched contracts, with heteroscedasticity-corrected standard errors. In column (1) the sample includes all accounts that were initially paying (i.e., both (pay, pay) and (pay, not pay)), with the dependent variable equal to one for those that switch to not paying (i.e., (pay, not pay)). Conversely, column (2) includes all accounts that were initially not paying, with the dependent variable equal to one for those that switch to paying. All the independent variables are averaged over all months before a switch, and annualized. The "% Months Borrow" measures the fraction of months before the switch that the account holder borrowed. For other definitions, see Tables 3 and 5.